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ABSTRACT

A classroom cognitive intervention model for adolescents and adults who are deaf is described. The model provides mediated learning experiences whereby a person assists the learner in interpreting experience and learning problem-solving strategies. The program, entitled instrumental enrichment (IE), is based on the following principles: IE uses a metacognitive approach in which students are given repeated opportunities to reflect on their own thinking processes; IE develops the prerequisites for learning; IE recognizes that representational and symbolic levels of thinking are appropriate expectations; IE provides a mechanism for transfer of cognitive skills by students to real-life and curricular situations; and IE postulates that it is never too late in the individual's life for modifying cognitive structure. Nine studies on the use of IE with learners who are deaf/hearing impaired are discussed. Studies indicate that students measurably improved in skills of reading comprehension, mathematical computation, problem-solving, and abstract thinking. (Contains 28 references.) (SW)

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ED 390 185

MEDIATED LEARNING EXPERIENCE AND DEAF LEARNERS

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The question of deaf learners' potential for higher-order reasoning has been the subject of much historical debate and considerable recent research.

During recent years, the program Instrumental Enrichment (Feuerstein, 1978) has been widely used. This classroom intervention program for adolescents and adults uses content-free paper-and-pencil exercises to correct deficient cognitive functions and provide the prerequisites for learning and problem-solving. Specific skills enhanced through the program include: analytic perception, projection of virtual relationships, orientation in space, comparison, temporal relationships, hierarchical relationships, syllogistic thinking, categorization, synthesis, and sequential progression. A program such as this, stressing both concept formation and application, has enormous potential benefit for deaf students. Research results with this particular program at this time are extensive and may serve as a basis for cognitive research with deaf learners using other intervention programs in the future.

The Nature of Instrumental Enrichment: An Intervention Model

The program Instrumental Enrichment (IE) was developed in response to the need for mediated learning experience (MLE); mediation is that activity in which a person assists a learner in interpreting experience and in learning strategies for problem-solving.

Instrumental Enrichment provides an excellent mechanism for the following reasons:

1. It uses a metacognitive approach in which students are given repeated opportunities to reflect on their own thinking processes

2. IE develops the prerequisites for learning and does not assume that those prerequisites already exist in the learner.

3. IE recognizes that representational and symbolic levels of thinking are appropriate to expect from the adolescent and adult learner, and mediates the learner in those modalities.

4. IE does not assume that generalization will automatically occur; rather, a critical element in the daily instructional sequence for IE is the "bridging" activity in which the teacher overtly and actively promotes transfer of cognitive skills by the student to both real-life and curricular situations, through discussion for insight.

5. IE is based on the concept of cognitive modifiability in the sense that it is considered never too late in the individual's life for modification of cognitive structures to be made.

An example of the interaction behavior between episode, for which IE teachers are trained, would be as follows:

1. Students in a language course carry out an IE task involving the comparison of pairs of words with somewhat similar meanings, and are asked to delineate the specific differences and similarities between the words.

2. The instructor then discusses with the students the mental processes which they used to solve these problems (looking at the entire problem first; fine discrimination between words that appear to have the same meaning; keeping in mind several sources of information; using what is know, what is seen, and what can be inferred; and checking for error). This discussion would be considered metacognitive.

3. The instructor then discusses with students how that particular skill of comparison can be applied (or "bridged") to the subject-matter of the course, e.g., in language--comparison of two characters in a narrative; comparison of two pieces of writing which are designed to communicate the same message; or comparison of two modes of communication for the deaf learner.

4. Finally, the instructor later in the context of the language course refers again to the skills of comparison learned from these exercises, as a way of reinforcing the importance of the comparison process.

Thus, for all of the above-stated reasons, the IE program represents a highly logical intervention step in the history of cognitive intervention programs.

Results of Instrumental Enrichment with Deaf Learners

Prior to the 1980's, IE had been used on a limited basis with deaf student populations. Then, pilot experiments testing the Instrumental Enrichment program with deaf adolescents at the Model Secondary School for the Deaf at Gallaudet University indicated that students measurably improved in skills of reading comprehension, mathematical computation, systematic approach to problem-solving, organization of solutions to subject-matter problems, and abstract thinking (Martin, 1983a). Another one-semester pilot study with Gallaudet undergraduate students in teacher preparation using the identical program showed similar improvement in precision, ability to compare, ability to explain, and diagnosis of errors in their written work (Martin, 1983b).

Nine studies applying the Instrumental Enrichment program to the needs of deaf learners are now summarized:

1. A controlled study with high school age deaf students (Martin & Jonas, 1986) was designed to examine the effects of the IE intervention for deaf students. Six IE instruments (parts-wholes, comparison, symmetry, projection of virtual relationships, spatial relationships, following directions, and classification) were used over a two year period with an experimental group of secondary-level deaf/hard of hearing students.

The specially trained teachers at least twice per week incorporated a series of sequences visual, verbal, and geometric problems into the regular subject matter; helped students solve these problems; then discussed how the students' mental strategies within these problems would be used in the subject matter.

The study took place at the Model Secondary School for the Deaf (MSSD) at Gallaudet University in Washington, D.C. Performances of a control group of 41 students and an experimental group of 41 students were contrasted using several measures of cognitive functioning. Groups were matched on the basis of age, sex, degree of hearing loss, and reading ability; IQ data were not available for the matching

process. Hearing loss averaged 88 dB; reading level averaged 4.5 (GES) on the SAT-HI; and age averaged 16.5 years old.

In addition to the use of the Raven's Standard Progressive Matrices and the Stanford Achievement Test-Hearing Impaired (SATI-HI), problem-solving situations were presented for written responses. The three problems were:

a. Suppose you are responsible for planning a trip for a class to go from MSSD to downtown Washington for a whole day to visit the Capitol building. What steps would you take? Please list the things you would have to plan.

b. If you had to tell someone exactly how to walk from the Auditorium at MSSD to the Cafeteria, what directions would you give him or her?

c. You are in a restaurant downtown with a MSSD friend. After dinner, your friend becomes sick from the food he has eaten. He can't walk, and he is in pain. The restaurant manager refuses to help you. What would you do? Results indicated that IE students improved in thoroughness, detail, and sequence in their responses to problems when compared to the non-IE students. Problem-solving situations were selected as a means of assessing students' planning behavior, problem-identification ability, skill in dividing a problem into its components, and understanding of cause and effect relationships. Two independent raters were trained to a .85 level of interrater reliability on sample problems, and then were asked to rate each student's pre and post responses through a "blind" process in which raters knew neither the group to which any subject belonged nor whether it was a pre or a post measure.

Finally, teachers other than the IE teachers were asked to rate all experimental students' cognitive behavior before the beginning of the experimental period and again near the end of the first project year, using a five-point scale of behaviors which reflected the major goals of IE. Because the reporting teachers were not those involved in the teacher-training group, they had no specific preconceived expectations for any changes in student behavior.

The gain by the IE group on the Raven's matrices exceeded that of the control group at a .022 1evel of statistical significance. The results of the Reading Comprehension subtest of the SAT-HI indicated that the experimental group exceeded the control group at a significance level of $p<.05$; IE students improved by 15.6 scaled score points. This significant improvement in reading comprehension can be explained by the added focus through IE on the prerequisite skills of comparison and projection of relationships. The IE group exceeded the control group on the SAT-HI subtest on math computation. The IE instructional emphases on precision, taking time to think (restraint of impulsivity), and checking one's own work would explain this important gain in the IE group of students.

Scores of experimental subjects on the SAT-HI math concepts subtest of the SAT-HI indicated a statistically significant difference demonstrating greater progress by IE students in the acquisition of math concepts by the end of the experimental period as compared to the control group.

Teacher Observation of Behavior. The rating of experimental group students by teachers in courses other than those in which that group had their IE experiences found the following trends in IE students:

An increase in self-control behavior--a direct result of IE activities stressing the location and correction of error.

A tendency to move directly to expected tasks--probably because the tasks are intrinsically motivating. An increased "sense of responsibility".

Giving more relevant and complete answers--the teaching methodology which stresses the discussive approach with continuous teacher demands for elaborated responses.

Increased willingness to help others in class--a behavioral by-product of IE because peer mediation is actively encouraged by the structure of IE lessons.

An increase in "confidence in tasks"--the result of the non-traditional nature of

the IE on-paper tasks, which allows students to experience success in problem--solving where they have previously experienced some failure.

An increase in working well with others in a group--the consistent teaching style of group discussion following completion of each day's exercises also clearly reinforces positive intra-group behavior by members of the class.

An increase in "consideration of others' feelings" and increase in "listening" behavior--indicating growth in students' openness to alternative solutions to problem situations.

A decrease in impulsivity--directly related to one of the major goals of IE: to encourage students to take time to think through a problem before upon a solution. Students often reminded each other about the importance of not jumping at the first solution which comes to mind.

A reduction in involvement in arguments.

In regard to the cognitive problems of the deaf/hard of hearing, these data indicate that this intervention holds promise for the improvement of spatial reasoning skills (Parasnis & Long, 1979); ability to consider two or more sources of information simultaneously (Ottem, 1980); ability to carry out analogical reasoning (Meadow, 1980); develop the concept of comparison and opposition (Furth, 1964; Meadow, 1980); and understanding of cause and effect relationships (Johnson, 1981). To the degree that memory is involved with the reading comprehension and mathematics computation subtests of the SAT-HI, it would also appear that the memory problem cited by Karchmer and Belmont (1976) is amenable to improvement. In addition, the emphasis on metacognitive activities during IE lessons must be considered as at least one factor in the improvement of experimental students; this interpretation should corroborate the finding elsewhere (Peterson et al., 1983) that students who can explain why they understood a cognitive task tend to have higher achievement scores.

Other applications of IE to deaf populations have been studied and are now reported.

2. Positive results from IE intervention have been reported from implementation of I.E. at the Western Pennsylvania School for the Deaf (WPSD) (Craig, 1987). Over a two-year period, secondary-level students in the experimental groups were provided with systematic instruction in cognitive skills for at least two class periods per week, using IE, while the control groups received the regular academic instruction (e.g., reading, language, mathematics) usually scheduled at that time. The WPSD study included 20 experimental and 20 control subjects. Results from the WPSD study (Craig, 1987) showed that the students trained in IE made significantly higher gains than the control students on the Reading Comprehension subtest of the SAT. Over the 2 years, the IE-trained group made a scaled score gain of 14.7, compared to the non-IE group gain of 9.5 ($s=3.83$; $p<.01$). For the IE group, this represents a Grade Equivalent (GE) gain of 1.68 (or 0.84 per year), almost tripling the average yearly gain in SAT Reading Comprehension reported for deaf students nationwide (Trybus & Karchmer, 1977). The WPSD experimental group also gained significantly higher scores on the Minnesota Paper Form Board (a measure of spatial problem-solving) than did the controls ($t=3.23$; $p<.05$). Both IE and non-IE groups made significant gains in Math Computation on the SAT and on the Raven's Standard Progressive Matrices, although group differences here were not significant.

Thus, this study, in both its design and results provides an important replication of the study reported by Martin and Jonas (1986) as well as extends the research further in the area of spatial and reading skills.

3. Feuerstein's (1979, 1980) theoretical construct (mediated learning theory) concerning the etiological nature of cultural deprivation is hypothesized to apply also to certain deaf populations. Initial studies on the cognitive modifiability of a deaf population indicate this population responds with high degrees of modifiability when exposed to mediated treatment (Keane, 1983; Keane & Kretschmer, 1983). In terms of educational practice, these findings indicate a level of potential that is not usually apparent from the academic performance of this population. An investigation (Keane & Kretschmer, 1987) found that the Feuerstein approach of mediated learning as outlined above also resulted in significant transfer of learning on other cognitive behavioral measures not associated with the teaching method itself (Instrumental Enrichment).

This result is important because it supports the entire concept of "bridging" as cited earlier in the discussion on the nature of I.E. and also supports the entire area of application that was discussed in the Martin and Jonas (1986) study, in the three real-world problem-solving situations posed to those students.

4. A study by Krapf (1985) with deaf adolescents using mediated learning experiences similar to Instrumental Enrichment demonstrated that this approach has a measurable and positive impact on figural analogic reasoning; it was also found that deaf adolescents as a result of this methodology can use two or more sources of data if mediation takes place, and students were found to be capable of using metacognitive problem-solving skills in the sense of being able to explain why certain strategies did or did not work. The results of this study also demonstrated that deaf adolescents after mediation will use symbols and operations that reflect relational thought--that is, formal operational thinking.

Again, these results support the transfer findings of several of the others reported studies, since analogy is the critical element in the "bridging" process. Krapf's metacognition results anticipated similar findings by Martin and Jonas in 1986.

5. Still another study with Instrumental Enrichment and deaf adolescents at the North Carolina School for the Deaf (Haywood et al., 1988) found significant positive effects on students' reasoning aptitudes, although showing inconsistent effects on achievement in academic areas.

The failure to find positive academic achievement results is an exception to the other studies cited, but does not rule out those effects entirely.

6. A study by Finer (1990) investigated the problem of lack of transfer in deaf students' application of the Feuerstein problem-solving skills. He developed a special course of visually-based discussion tasks as a conceptual framework to support the cognitive areas of: complexity, ambiguity, interpretation, abstraction, explanation, and understanding alternative viewpoints. Research with this method with prelingually deaf students in secondary schools in England is under way.

Results of this work have the potential to inform future research directions and clearly encompass a number of the cognitive behaviors which teachers were asked to evaluate in students in the earlier studies cited.

7. A study by Berchin (1989) investigated whether there is a chain of functional relationships among mediation, the cognitive function of spontaneous comparative behavior, the operation of categorization, and the reading comprehension tasks of using lexical cohesion and finding the main idea. The experimental treatment was the categorization "instrument" from IE. The overall procedure for this study followed a multiple-baseline across-subject design. The baseline was a traditional or direct experience in teaching the operation of categorization while the experimental treatment was a mediated experience in teaching the operation of categorization. The dependent variables (number of spontaneous comparative responses score on the spontaneous comparison, quality of the commonality and the difference in the response, and number of most salient verbs and class nouns used), were charted for each subject from baseline through treatment. The dependent variables were also charted to investigate the acquisition of categorization. The subjects were probed four times through the study for the near-transfer of the ability to compare spontaneously and categorize and the far-transfer of the reading comprehension tasks of using lexical cohesion and choosing the main idea. Results indicated a treatment effect for all three subjects for all the dependent variables as well as for the acquisition of the operation of categorization. In addition, a treatment effect was only evident for two subjects for one test of the near-transfer of categorization and one subject for the other near-transfer test of categorization. The far-transfer results were inconsistent. Although there was an upward trend for all three subjects on all tests, a treatment effect was only established for one of the far-transfer tests.

Although the far-transfer effects do not support earlier studies' results in regard to the results of "bridging", near-transfer seems to be supported. In addition, the planned and explicit teaching of cognitive processes (in this case, categorization) through I.E., is clearly supported as an effective means of improving cognitive performance and thus supports several of the other studies.

8. An application of IE to the needs of deaf college students at the National Technical Institute for the Deaf was reported by Senior and Reber (1989). They stated that problem-solving sessions with IE resulted in: reduced fear of problem situations, improvement in identifying cognitive strategies to be used, explanation of alternative strategies, application of strategies to moved situations, reduced impulsivity, and adoption of specific cognitive vocabulary by the college students.

These results clearly reinforce the Martin and Jonas (1986) findings in regard to problem-solving behavior, reported now by teacher observations with younger deaf adolescents than in that earlier study.

9. Another study of IE was carried out by Martin and Jonas (1989) to improve the cognitive skills of deaf college students. Ninety-one entering students at Gallaudet University were identified as experimental students, and were matched with ninety-one students as controls for the experiment. Experimental students received systematic cognitive instruction focusing on specific generalizable skills during the experimental period, several times per week, in the contexts of their regular college classes. Instructors of the experimental group were given special training over a two-year period in the methodology of IE. Experimental students were given practice in skills of organization, orientation, comparisons, analysis, classification, following instructions, temporal relationships, sequencing, and logic. Experimental and control students were given pre- and post-testing with the Stanford Achievement Test Hearing-Impaired (SAT-HI), the Raven's Matrices, a systematically analyzed writing sample, a University reading test, and a self-administered survey of the ways in which students saw themselves as thinkers. Demographic data were collected on all subjects in relation to age of hearing loss, level of hearing loss, and gender. Evaluation results indicated that cognitive instruction of this nature produced statistically significant improvement for experimental subjects in expected directions on the Raven's Matrices, and the SAT-HI test (Reading Comprehension, Math Concepts, and Math Computation). A relatively high rate of attrition was noted in the sample groups and may have prevented statistically significant differences on other measures.

A series of summarized results from this study follows:

a. The IE and control samples were comparable on all background and pre-test measures collected.

b. The gains on the Raven's Progressive Matrices were significantly higher for the IE group as compared to the control group.

c. The scores on the SAT-HI Reading Comprehension test were significantly higher for the IE group as compared to the control group.

d. The scores on the SAT-HI Math Concepts test were significantly higher for the IE group as compared to the control group. Also, the length of IE exposure (two versus four semesters) significantly favors longer exposure.

e. The scores on the SAT-HI Math Computation test were significantly higher for the IE group than those for the comparison group.

f. The Gallaudet University Writing Placement test did not show any significant differences between IE and control groups at time of entry.

g. In the entire group (both IE and control combined), males outperformed females on the Raven's pre- and post-test, but both sexes gained the same amount of points. Males also outscored females on Math Concepts and Computation.

h. Looking at the IE group only, males performed better than females on the gain score of the Raven's Progressive Matrices, the Math Concepts, and Math Computation tests.

i. Within the top 25% of the IE score distributions on the Raven's Progressive Matrices and the SAT-HI battery of tests, representatives of both sexes, and all levels of hearing loss did well enough to be included on one or more of these post-test measures.

j. Most often the high-achieving IE student did well on the Raven's Progressive Matrices (i.e., gained three or more points) and had four semesters of exposure to IE materials.

A related question arose in this study, "What persisting change, if any, can be seen among the first-year instructors after they were no longer required to implement the thinking skills program?" That question is not easily answered. However, during 1986-87, while the experimental group was in its second year, the investigator examined the activity of first-year instructors (from 1985-86) as they began to teach a new entering group of students (who were not a part of this experiment). These instructors chose to continue their own training in IE in second-year instruments and also voluntarily implemented IE with their new group entering students.

Analysis of pre- and post-test results in 1986-87 in first-year algebra--a subject taught by two of these instructors--in comparison with other algebra classes taught by non-IE instructors indicated a statistically significant difference ($p<.01$) in favor of the students in these two experienced IE instructors' classes.

Three conclusions may be drawn from these admittedly limited data:

a. Trained IE instructors tend to persist in their interest in implementing the teaching of thinking skills.

b. Students in the classes of experienced IE teachers show significant gains over those in other classes, even though the instructors are not required to implement IE.

c. IE as a method of teaching thinking skills has the clear potential to become institutionalized as a part of the college curriculum if instructors are appropriately trained and have continued access to needed materials.

This apparent potential for institutionalization is a critical element in the long-range thinking behind this project and is a truly encouraging indication for the improvement of cognitive skills.

The investigator also interviewed randomly selected experimental subjects as well as the instructors in the experimental group. These data are used to assist in the interpretation of the statistical findings and to broaden the base of information on the results of the experiment beyond paper-and-pencil instruments.

Students were asked to respond to the question, "In what ways have you started to use Instrumental Enrichment?" Five students of the twenty randomly selected experimental subjects responded that they were not aware of any change; an additional two students expressed only that they were concerned with the amount of time that Instrumental Enrichment seemed to "take away" from learning English. The remaining students (13) all replied in some form that they believed that their thinking patterns had become more careful or systematic or less impulsive. A sampling of the responses of this latter sub-group are presented below to demonstrate the support for this latter interpretation:

Student	Statement
a.	"I found that I started to slow down before I guessed at an answer to a problem. "
b.	"I think I started to look at the whole thing instead of the parts of a problem. "
c.	"I think IE has been good for me--I can think better."
d.	"It takes me a little longer, but I think I get more right answers now."
e.	"I try to look for the reasons underneath the answers now before I write an answer."

During the interviews with the experimental instructors, the key question was, "What types of responses to the program did you see happening in your students in the experimental group?" Instructor responses to this question helped to elaborate further on the above student responses. Among the instructors' observations was the clear trend that experimental (IE) students began to demand that their instructors give them further verbal elaboration on their responses, thus reflecting the same elaborative style

that the instructor had been trying to model for them. For example, students were reported by experimental instructors to demand this reasoning both from each other and from the instructor with words such as:

a. "Explain it to me, please."

b. "Give me the evidence for that."

c. "Could I have another example, please?"

d. "I think I have the idea; let me give you an example and see if I know it now."

e. "How does that connect with what I already know?"

Students were also reported by experimental instructors to argue with one another over points during class, whereas previously they had merely accepted what the instructor had said or what each other said without question. It is clear from these sets of quotations that verbal elaboration behaviors were enhanced by the program; no such responses were reported from students in non-Instrumental Enrichment classes by experimental group instructors.

The second key question in the interviews of IE faculty was, "What overall changes do you see as a result of the experiment?" The following points were made by IE faculty interviewees:

a. Students in the experimental group began to feel the "strength" of their reasoning powers.

b. The students in the experimental group moved further ahead into higher level English and math than had been the case in previous years with similar groups that did not have Instrumental Enrichment.

c. Students demonstrated more confidence in themselves during examinations.

d. Students began to be able to use more than one piece of information at a time in activities requiring that behavior.

e. Test scores on teacher-made tests demonstrated that students had begun to "reason better."

f. Students stopped giving up on difficult academic problems or being depressed about their difficulty.

g. Students became better note-takers; they began to ask the instructor to stop and allow them to take notes instead of the instructor having to stop and remind them to take notes (this is an important issue in teaching deaf students, who are normally not able to take notes during a lecture because of the need for visual attending).

h. Students at first resented the non-verbal materials in the program because they felt that they were for younger students; but by the end of the third semester, they indicated that they understood the value of the materials and began to ask for more practice in the non-verbal instruments as well as in the verbal instruments.

i. Instructors said that they believed their own style of teaching had changed permanently as a result of the training in the direction of: using more "wait-time" for student responses in discussions, using more cognitive terms in their teaching, and demanding higher-level responses from their students during discussions.

Thus, these data also demonstrate that important changes were taking place beyond what was noted in the test scores reported earlier, and in this sense reinforce the results reported by Martin and Jonas in 1986 as well as by several of the other works cited in this chapter.

Studies, then, have indicated that cognitive deficiencies similar to those delineated by Feuerstein (1978) with other populations are also evident within the deaf populations studied. It would seem that the pervasiveness of these deficiencies affects the learning ability of deaf children. In approaching the complex phenomenon of learning, it appears logical that these deficiencies affecting the mental act need to be addressed in order to promote independent learning. To facilitate this task, more research is needed. Further investigation of Feuerstein's theoretical construct of mediated learning as it applies to deaf populations could impact upon educational curricula, preservice and inservice teacher education, cognitive/intellectual assessment, and finally, parent-infant education programs that serve deaf children.

Needed Research

While the results of the studies cited above are truly encouraging because of the support they give for the effectiveness of systematic cognitive intervention programs for deaf learners, much remains to be investigated. Among the more explicit questions for future research in this domain, the following merit consideration:

1. To what degree are variations in teacher behavior important in determining the outcomes of a particular cognitive intervention program with deaf learners?

2. In what ways does the same cognitive intervention program affect deaf learners differentially according to their individual characteristics? Among the variables to be considered in assessing the impact of such programs would be: level of hearing loss, age-at-onset of hearing loss, gender, parental background in terms of education, socio-economic status, hearing status and age. Each of these variables has, in prior research, been shown to have some relationship to outcomes in other aspects of educational research with learners and should be investigated in connection with cognitive intervention programs with deaf learners as well.

3. In view of the current high interest in the use of American Sign Language as the medium of instruction for deaf learners, to what extent will a systematic cognitive intervention program, such as Instrumental Enrichment, foster higher-order

thinking if it is embedded in an American Sign Language context for deaf learners, in comparison with the results when it is embedded in a manually-coded English context?

4. Will the use of American Sign Language as the prime medium of instruction for a group of deaf learners in itself result in higher achievement in higher-order cognitive skills even if no systematic cognitive intervention program is implemented? What interaction effects are identifiable between the implementation of a higher-order thinking skills intervention program and the choice of language code and language mode?

5. To what degree will observable differences in higher-order thinking achievement from a cognitive skills intervention program be enhanced if the teacher (hearing or deaf) is skilled in code-switching during instruction between ASL and a manually-coded form of English?

6. What differences, if any, will be found in the success of Instrumental Enrichment with deaf learners who are students of teachers who themselves are deaf, versus hard-of-hearing, in comparison with hearing students?

7. In what ways will the incorporation of higher-order thinking skills programs in schools and programs for the deaf result in greater success in life and in the workplace for deaf learners? The answers to this question will, of course, depend on longitudinal studies which should be begun now so that the subjects can be followed through their careers. Perhaps, this research will be the most important of all in determining the effectiveness of such programs.

Other questions and sub-questions will follow from these, and will help to inform the research agenda with the next generation of both teachers and students.

Conclusion

In reviewing the historical development of attitudes toward the cognitive potential of deaf persons, we can identify a trend that passes from overt bias and in many cases discrimination, through the several phases of comparing deaf and hearing learners on some more specific measures but still over-generalizing or oversimplifying the results, thorugh a period of more systematic analyses which removed the tendency to over-generalize but still confused thinking and language issues. History then moved to a time when the performance of deaf persons began to be analyzed on its own terms. This was due in part, to a better understanding of the particular conditions under which a deaf learner develops. That understanding led to the more specific analyses which continue side by side with active efforts to improve the cognitive performance of deaf learners. Today, there is a strong belief that such improvement is not only possible, but essential to accomplish.

It is only by pro-active efforts in these directions that it can be assured that deaf learners will be enabled to reach their cognitive potential. To do less, is to assure the waste of an important human intellectual resource.

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